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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte BONG-CHULL KIM, CHEOL-HEE HWANG, DONG-YUNG KIM, SE-HO PARK, and HYUN-JUN CHOI

Appeal 2016-003563
Application 13/100,273
Technology Center 1700

Before CHUNG K. PAK, JENNIFER R. GUPTA, and JANE E. INGLESE, *Administrative Patent Judges*.

GUPTA, *Administrative Patent Judge*.

DECISION ON APPEAL[1]

Appellants[2] appeal under 35 U.S.C. § 134(a) from the Examiner's decision finally rejecting claims 1–3, 8–14, 18–20, and 24–28. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

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[1] In this decision, we refer to the Final Office Action mailed February 23, 2015 ("Final Act."), the Appeal Brief filed July 17, 2015 ("App. Br."), the Examiner's Answer mailed December 21, 2015 ("Ans."), and the Reply Brief filed February 19, 2016 ("Reply Br.").

[2] Appellants identify the real party in interest as Samsung SDI Co., Ltd. App. Br. 1.

The claims are directed to a negative active material for a rechargeable lithium battery and a rechargeable lithium battery including the same. Spec. ¶ 2. Independent claim 1, reproduced below, is illustrative of the claims on appeal.

> 1. A negative active material for a rechargeable lithium battery, comprising a carbon-nanoparticle composite comprising:
>
> a crystalline carbon material having pores; and
>
> amorphous conductive nanoparticles comprising silicon nanoparticles having a full width at half maximum at a (111) plane of about 0.35° to about 0.5° as measured by X-ray diffraction, wherein at least some of the amorphous conductive nanoparticles are inside the pores of the crystalline carbon material, or both inside the pores and on the surface of the crystalline carbon material, the amorphous conductive nanoparticles being present in an amount of about 5 to about 25 parts by weight based on 100 parts by weight of the crystalline carbon material, and having an average particle diameter of about 50 nm to about 200 nm.

App. Br. 11. Independent claim 18 is directed to a rechargeable lithium battery comprising the same negative active material as recited in claim 1. *Id.* at 13.

REJECTIONS OF APPEAL

1. Claims 1, 2, 8–14, 18, 19, and 24–28 stand rejected under pre-AIA 35 U.S.C. § 103(a) as unpatentable over Aramata et al. (US 2003/0215711 A1, published November 20, 2003) (hereinafter "Aramata") as evidenced by Kawakami et al. (US 2006/0127773 A1, published June 15, 2006) (hereinafter "Kawakami"); and
2. Claims 3 and 20 stand rejected under pre-AIA 35 U.S.C. § 103(a) as unpatentable over Aramata as evidenced by Kawakami in view

of Kim et al. (US 2009/0269669 A1, published October 29, 2009) (hereinafter "Kim").

ANALYSIS

The Examiner finds that Aramata discloses, *inter alia*, a negative electrode active material for lithium ion secondary cells comprising amorphous conductive silicon nanoparticles with a crystallite size of 2 nm to 20 nm as determined by the Scherrer equation ($L = K*\lambda / \beta\cos\theta$) based on the spread of the diffraction peak attributable to Si(111). Final Act. 3 (citing Aramata ¶ 27); Ans. 2. Using Scherrer's equation, and assuming K has a value of 1 and a wavelength of 0.154 nm, the Examiner calculates that the full width at half maximum for Aramata's crystallite size of 2 nm would be 0.05°, and the full width at half maximum for Aramata's crystallite size of 20 nm would be 0.5°. Ans. 5; Final Act. 5. Thus, the Examiner determines that Aramata's silicon nanoparticles would necessarily possess a full width at half maximum at a (111) plane that overlaps with the range recited in claim 1. Final Act. 5.

Appellants argue that although it was known in the art to calculate crystallite size by x-ray diffraction using Scherrer's equation, contrary the Examiner's assumption, there is no evidence of record, nor was it known in the art, to use Scherrer's equation to back calculate any variable of the equation based on the crystallite size, such as full width at half maximum. App. Br. 5–6. Additionally, Appellants argue that even assuming one of ordinary skill in the art would have attempted to use Scherrer's equation in the manner suggested by the Examiner, Aramata does not provide enough

information, e.g., the value for K, or the diffraction and/or instrument profiles, necessary to calculate the full width at half maximum. *Id.* at 6–7.

Appellants' arguments are persuasive of reversible error. On the record before us, the Examiner fails to provide any evidence that it was known in the art to use Scherrer's equation to calculate full width at half maximum. In fact, as Appellants point out, contrary to the Examiner's contention, the evidence on the record before us appears to suggest that Scherrer's equation cannot be used to accurately calculate full width at half maximum. Ahmad Monshi et. al., *Modified Scherrer Equation to Estimate More Accurately Nano-Crystallite Size Using XRD*, 2 World Journal of Nano Science and Engineering, 154, 155 (right col.) (2012) (hereinafter "Monshi") (stating that the calculated full width at half maximum values "[have] never been observed and cannot be true."). Moreover, even if Scherrer's equation could have been used to calculate full width at half maximum using crystallite size, the Examiner fails to provide any justification for assuming that the value for K in Aramata is 1 and the x-ray wavelength is 0.154 nm. Accordingly, we cannot find that Aramata, which merely teaches the use of similar silicon nanoparticles as those recited in claim 1, necessarily or inherently teaches that its silicon nanoparticles have a full width at half maximum at a (111) plane of about 0.35° to about 0.5° as measured by X-ray diffraction, as required by claim 1. Because both rejections on appeal are based on this error, we cannot sustain the rejection of any of claims 1, 2, 8–14, 18, 19, or 24–28.

DECISION

For the above reasons, the Examiner's decision to reject claims 1, 2, 8–14, 18, 19, and 24–28 is reversed.

REVERSED